The Weather Is Our Water Supply:

Community Involvement in Monitoring Climate

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Atmospheric Science Department
Colorado State University

Presented at New Mexico State University
March 10, 2005, Las Cruces, NM.

Prepared by Odie Bliss and Henry Reges

Beginnings

- After the State Climatologist positions were abolished by the federal government in the early 1970s, many states gradually established state funded climate offices. Many were at land-grant universities.
- The Colorado Climate Center was established at Colorado State University in 1974 within the Colorado Agricultural Experiment Station.

Who Are We?

- Roger A. Pielke, Sr.

  Professor, Atmospheric Science and State Climatologist, pielke@atmos.colostate.edu

- Nolan J. Doesken

  Climatologist and Senior Research Associate,

  nolan@atmos.colostate.edu

- Odie Bliss

  Coordinator, odie@atmos.colostate.edu

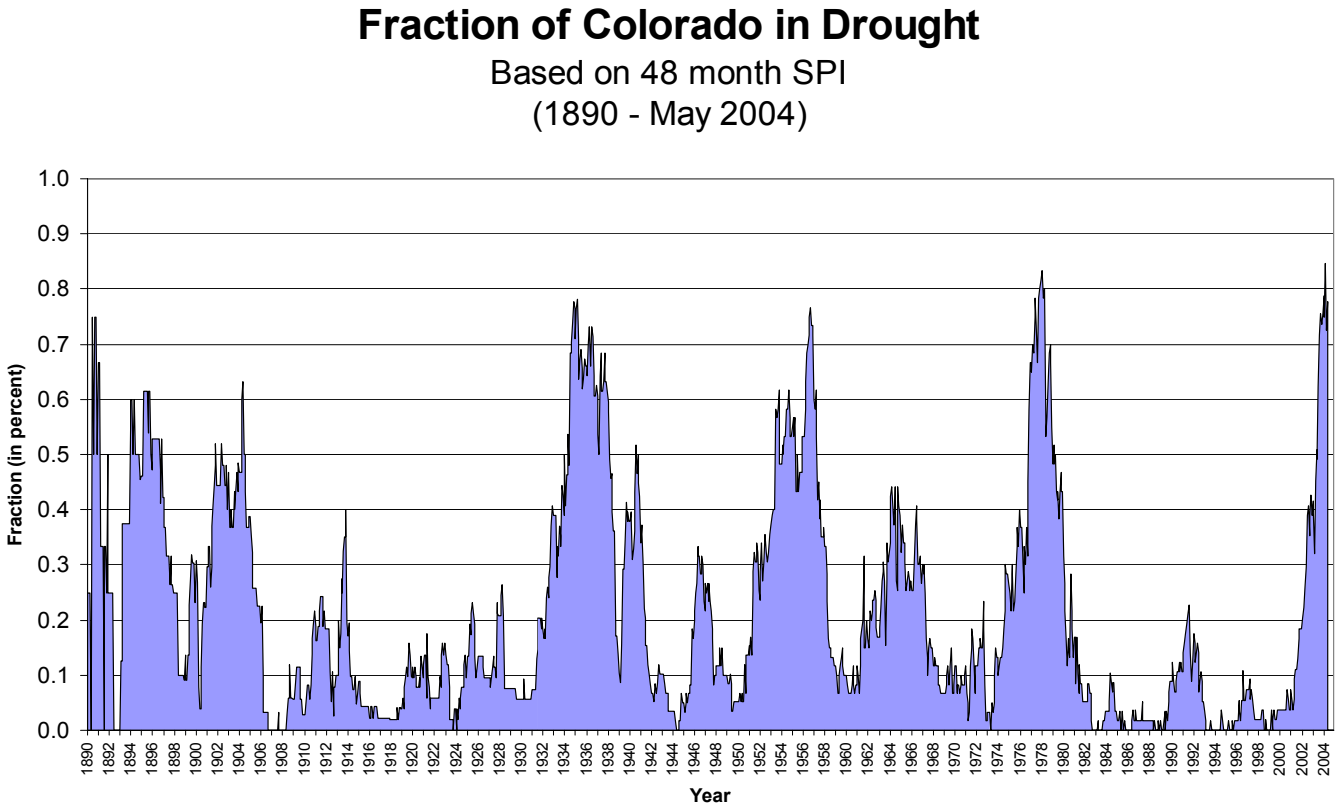
- Marty Osecky

  System Administrator

What We Do….

Climatic Research

- Instrument Comparison Studies, Drought, Snow, Variability and Trends, Impacts and Modeling, etc.

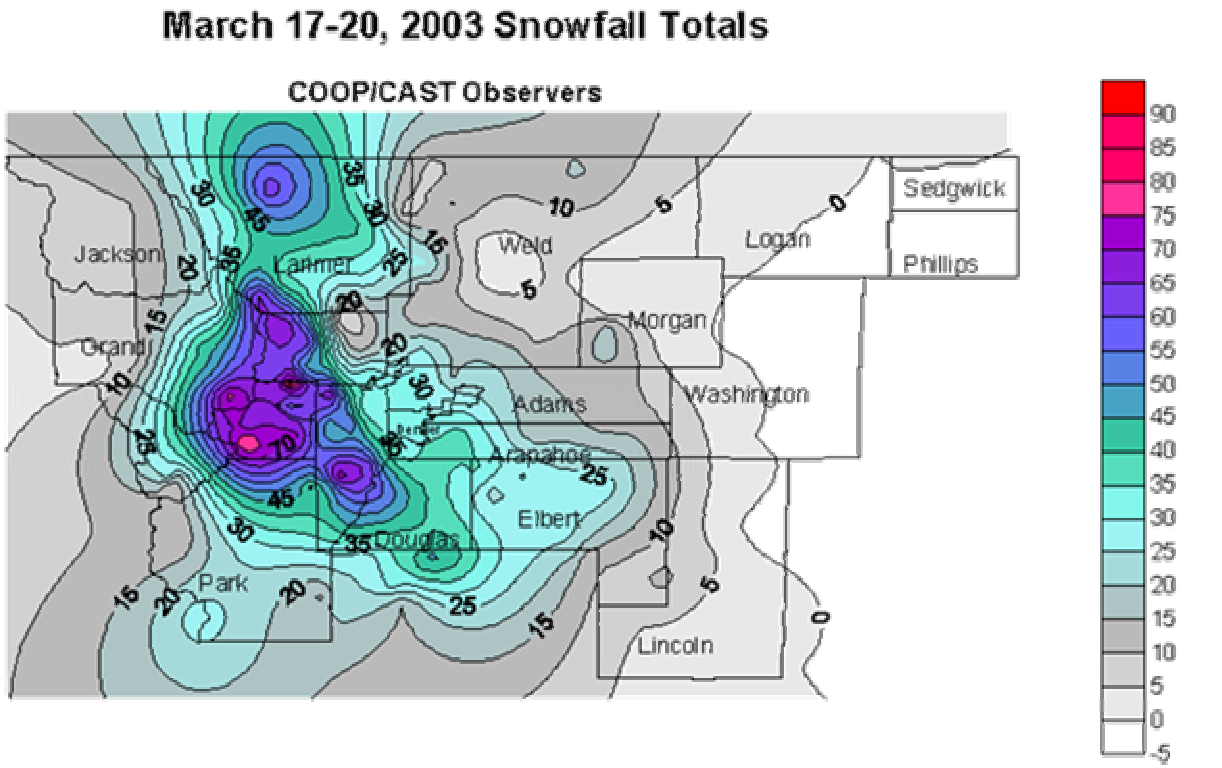


Data Acquisition and Archive

- Elements: temperature, precipitation, snow, wind, solar, evaporation, soil temperatures, humidity, cloud cover

Monitor the Climate of Colorado

- Drought, flooding, blizzards, tornadoes, temperature extremes, Heating/Cooling Degree Data, etc.



Disseminate Information

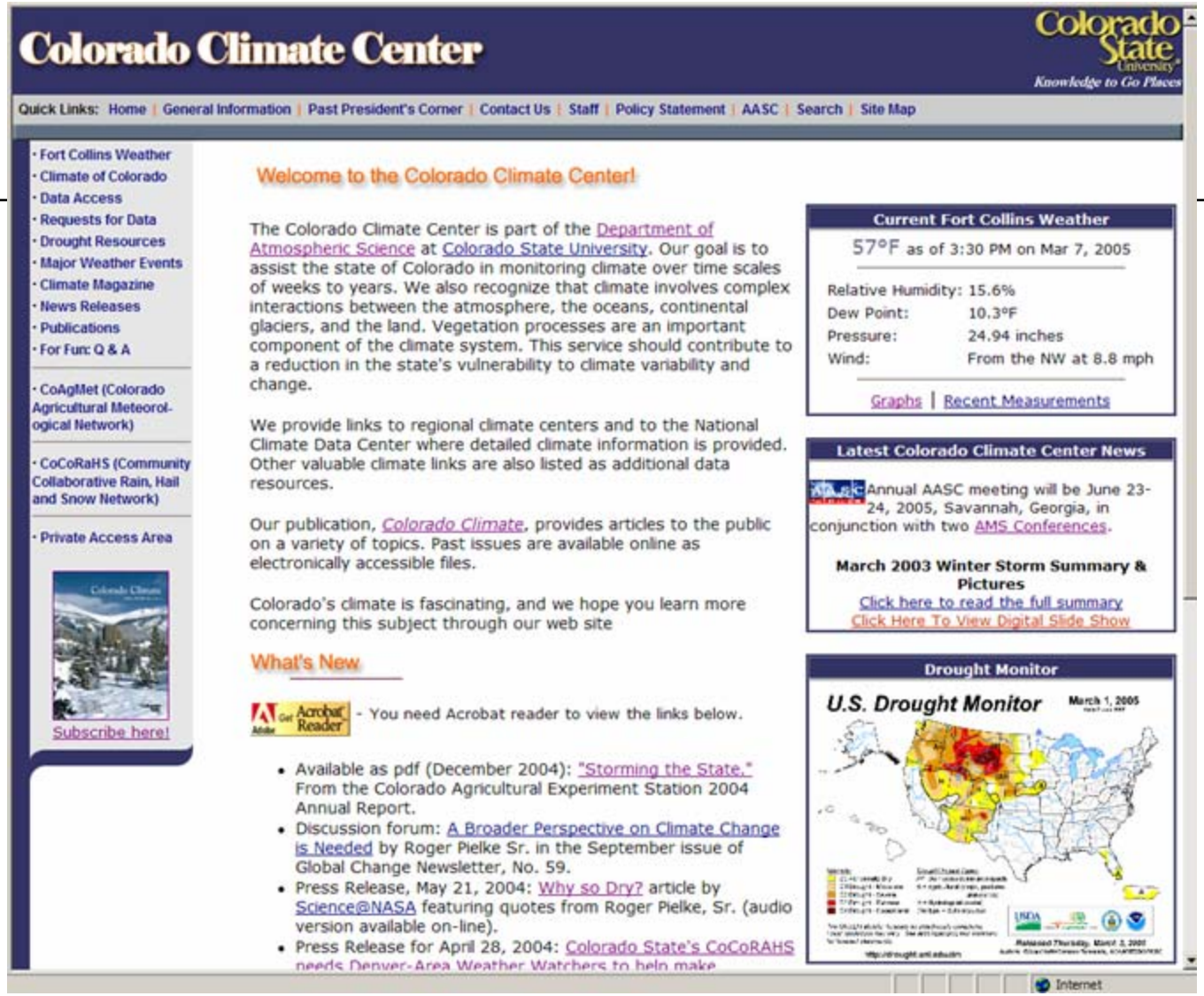
- Farmers, ranchers, consultants, engineers, water resources, utilities, construction, lawyers, federal, state and local governments, schools, universities, and many others.

- HOW? Website, phone, fax, email

http://ccc.atmos.colostate.edu

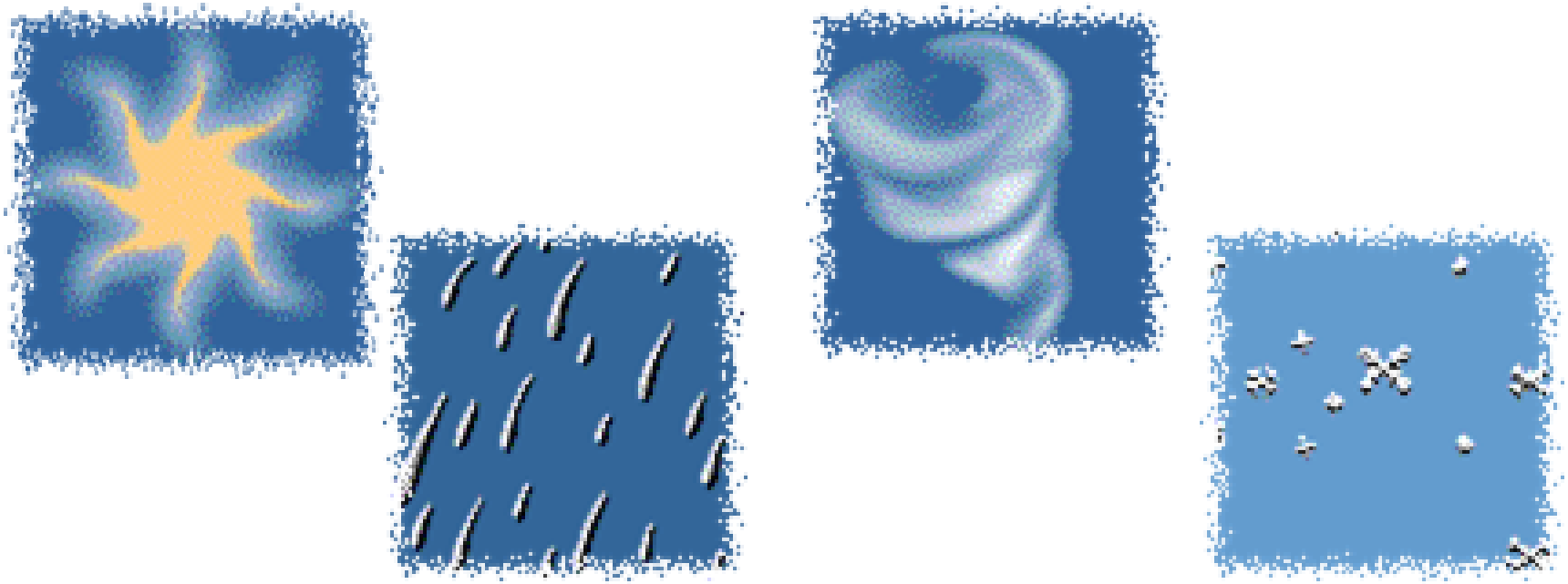
(970) 491-8545 phone

(970) 491-3314 fax

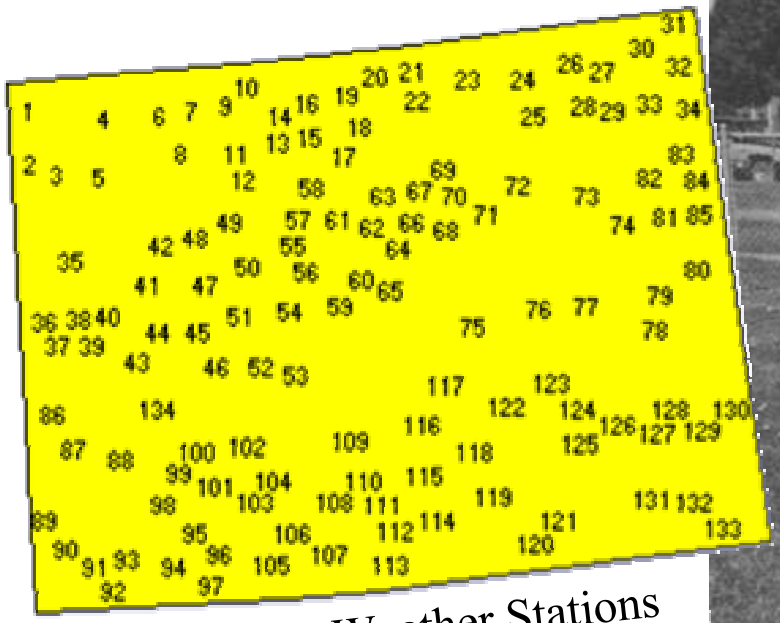


http://ccc.atmos.colostate.edu

How Do We Monitor Our Climate?



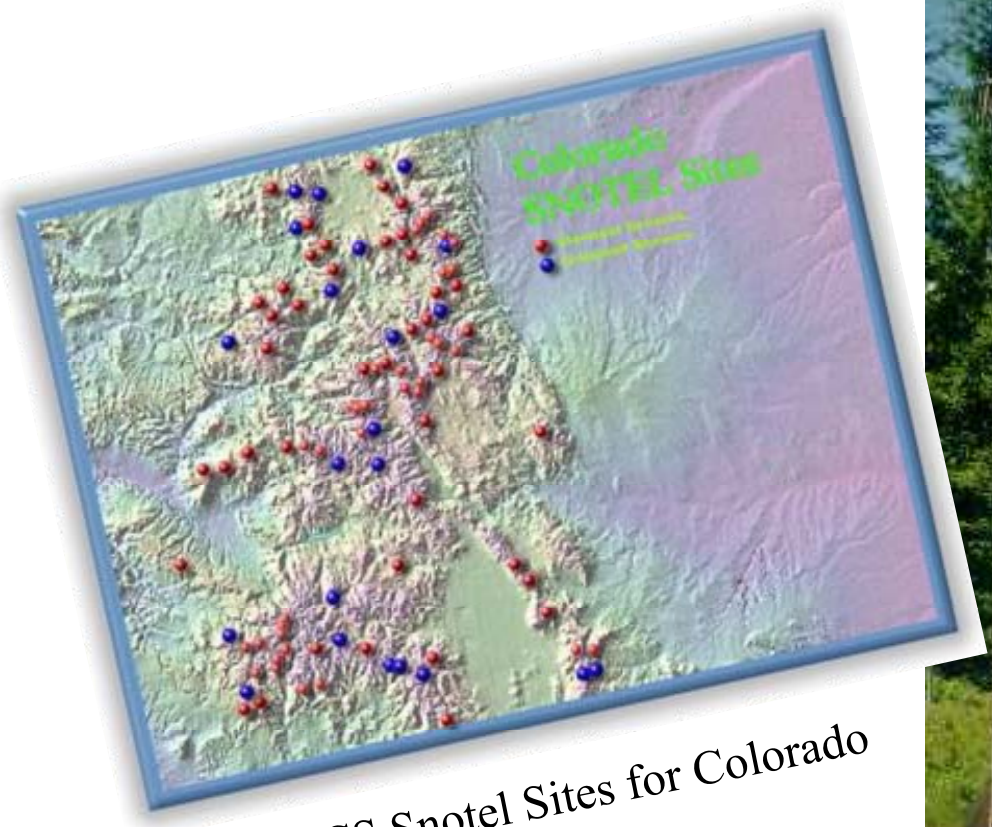
National Weather Service Collaboration



Cooperative Weather Stations in Colorado

Typical Cooperative Weather Station

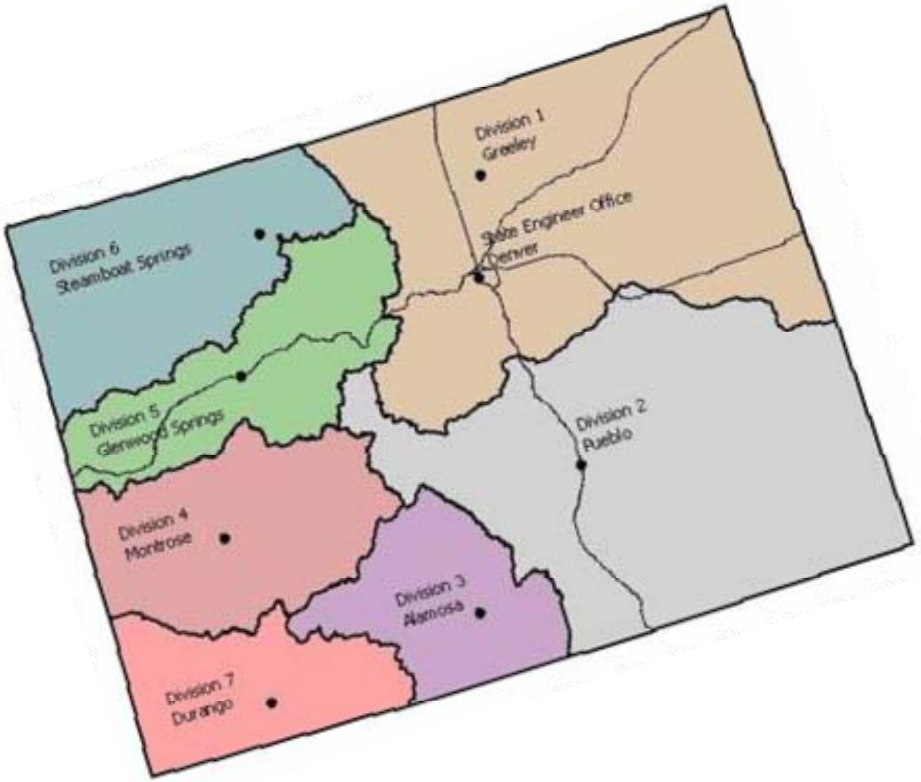
USDA, Natural Resources Conservation Service

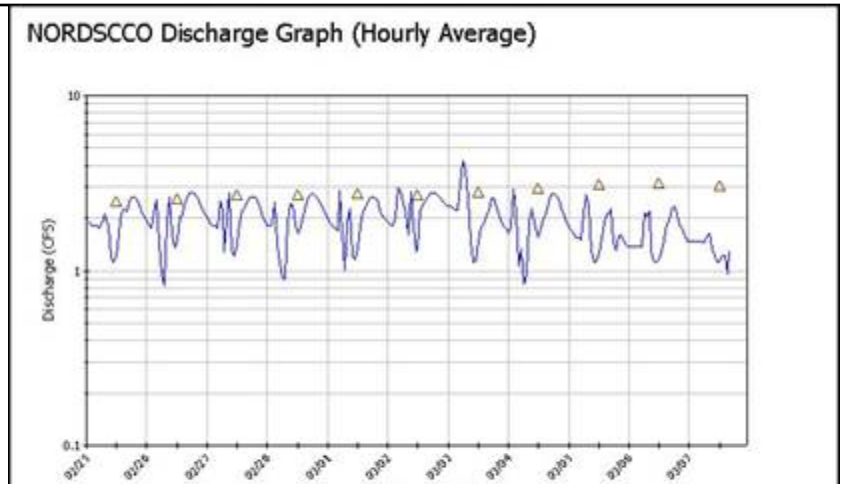


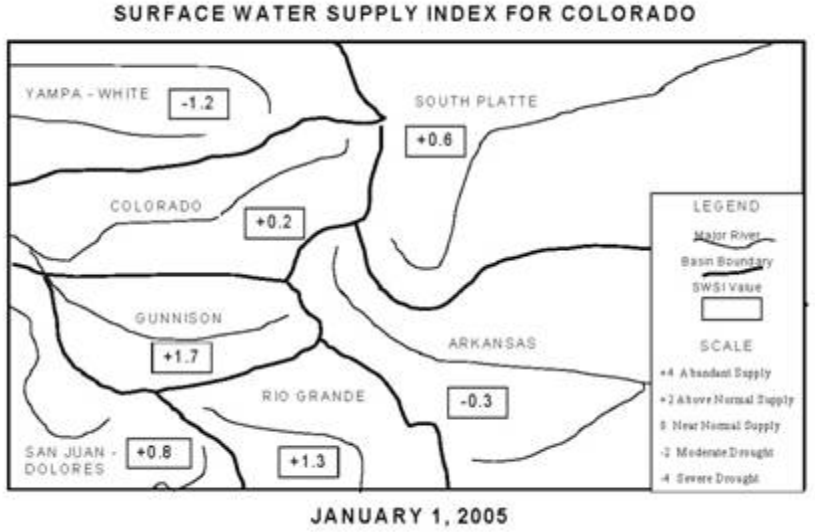
NRCS Snotel Sites for Colorado

Typical NRCS Snotel Site

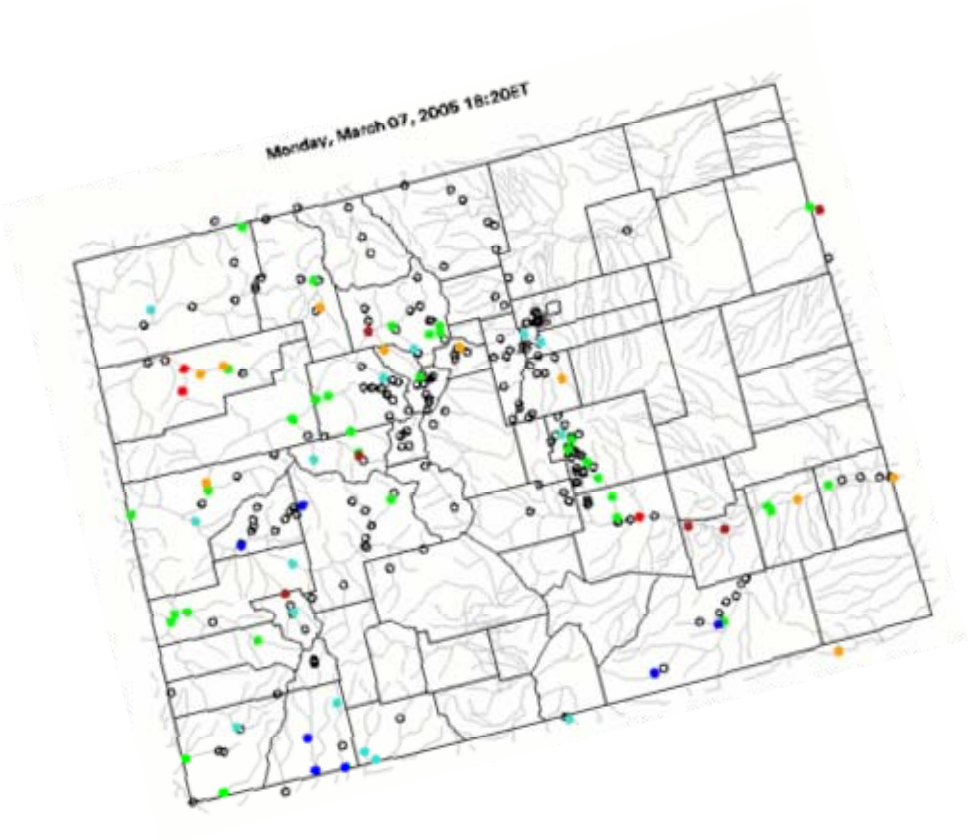
State Engineer's Office

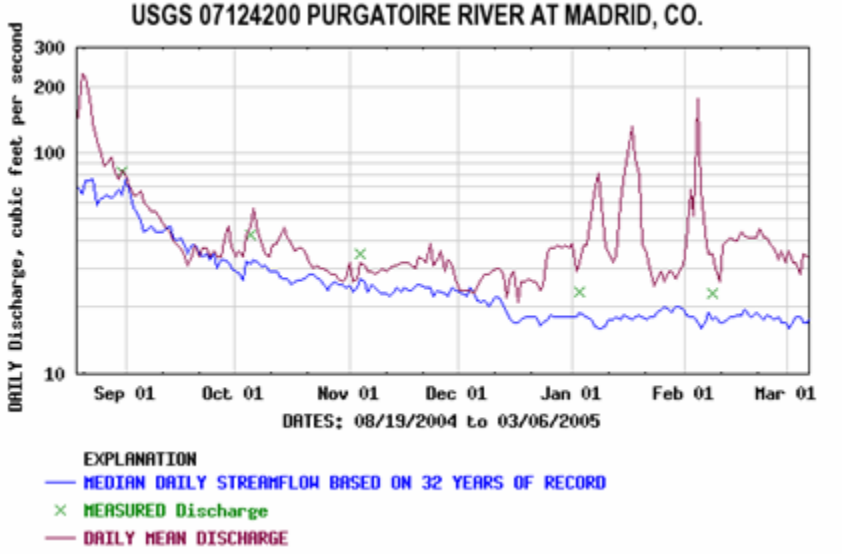






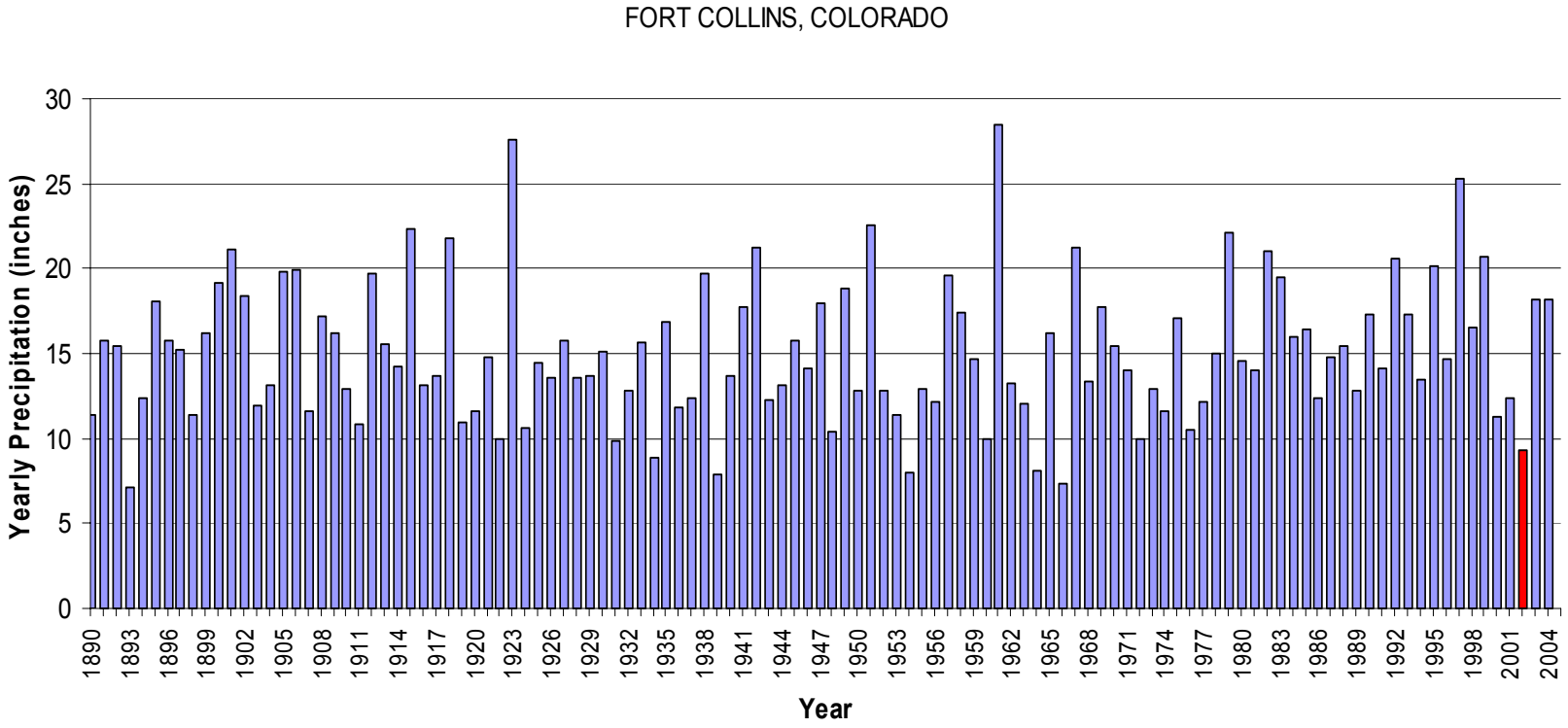
U.S. Geological Survey





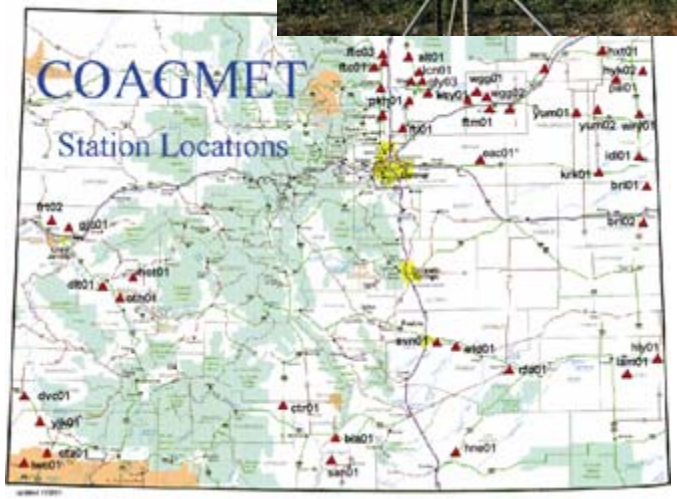
Colorado Climate Center Monitoring Activities

- Fort Collins Historic Weather Station – Continuous observations from 1889 to present



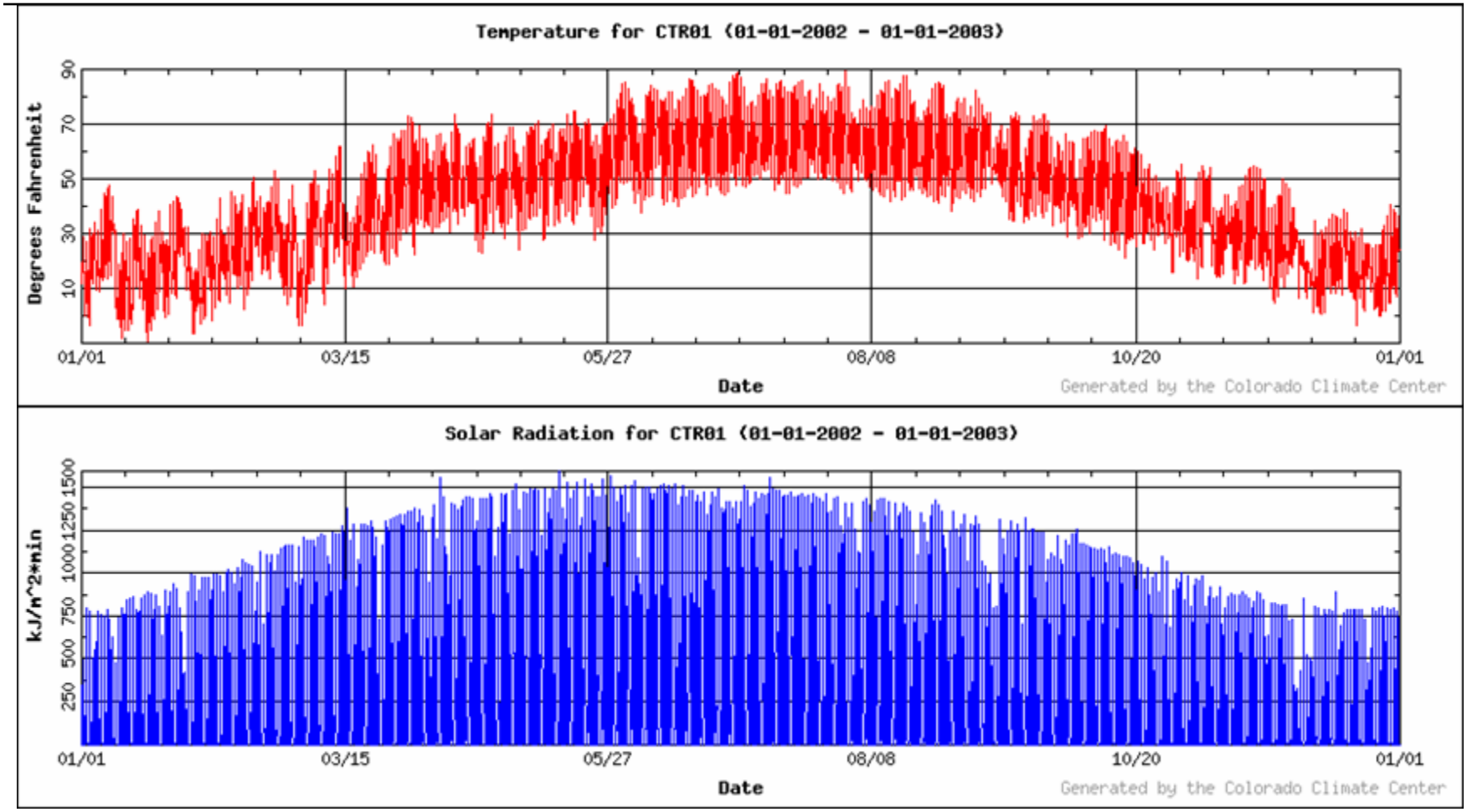
CoAgMet
Weather Data for Agriculture

- *Automated weather stations with daily and hourly readings of:*
  - *Temperature*
  - *Humidity*
  - *Wind*
  - *Precipitation*
  - *Solar energy*
  - *Evapotranspiration*

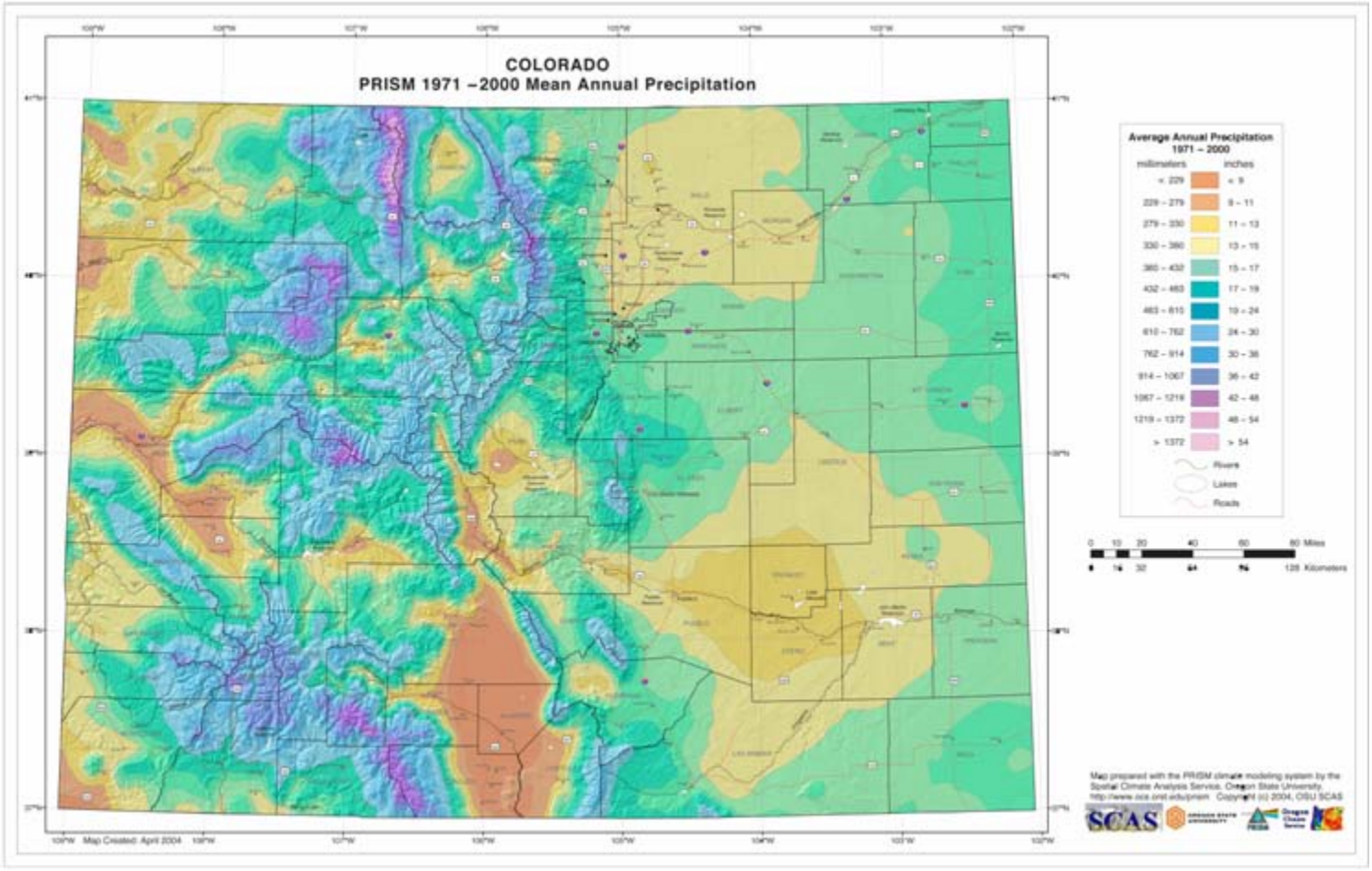


http://www.coagmet.com

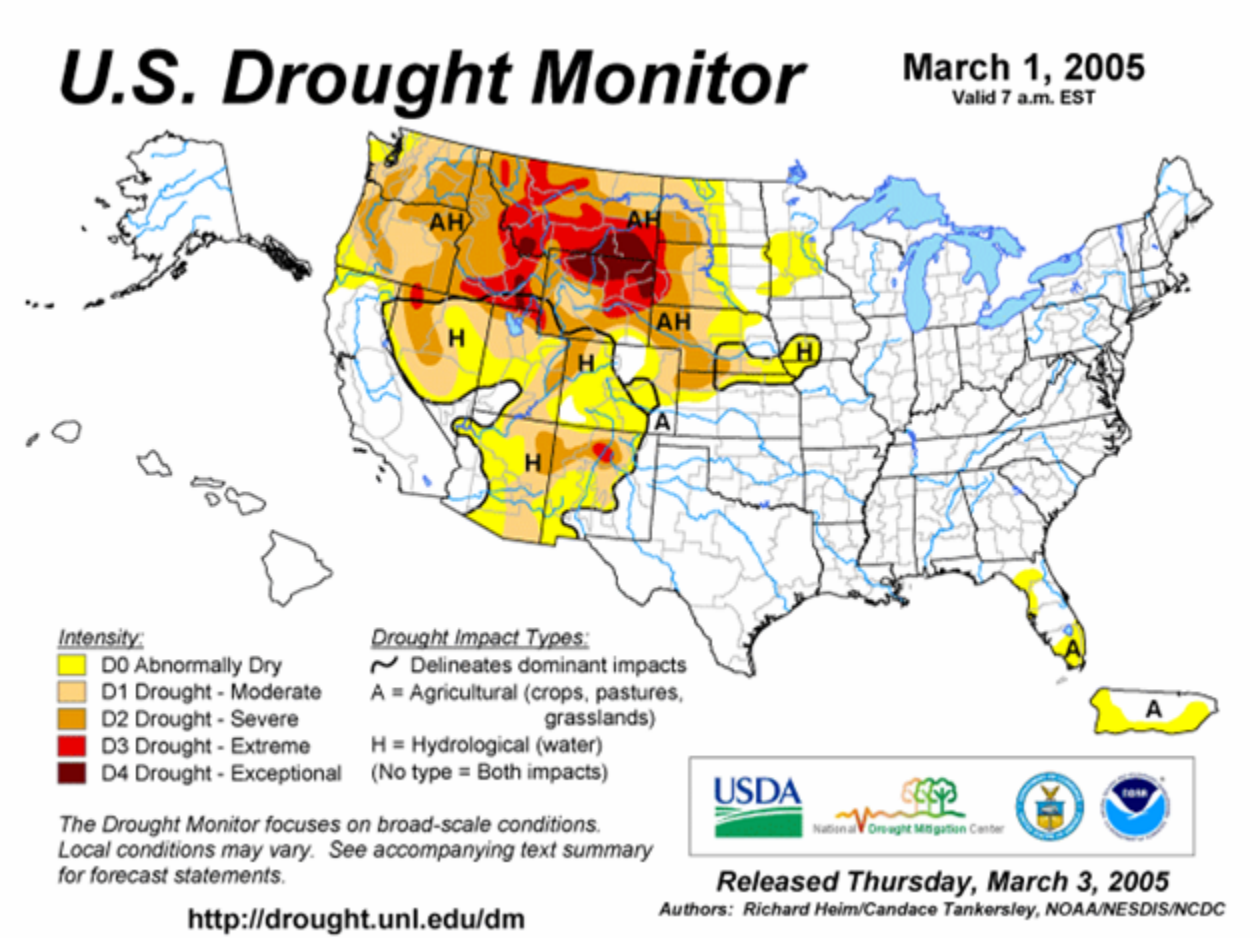
Center, Colo., CoAgMet Daily Values of Temperature and Solar Radiation



Applications of Climate Monitoring

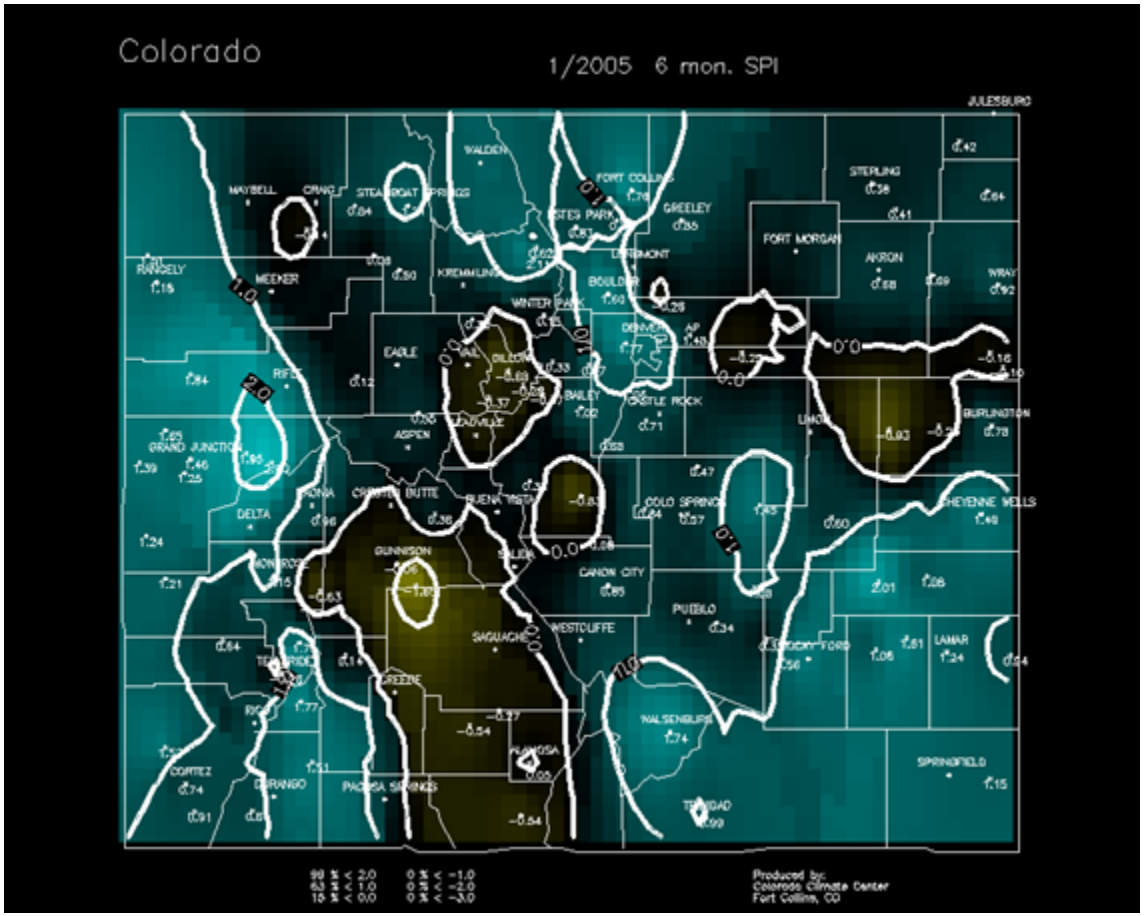


Applications of Climate Monitoring



Applications of Climate Monitoring

- Standardized Precipitation Index Map

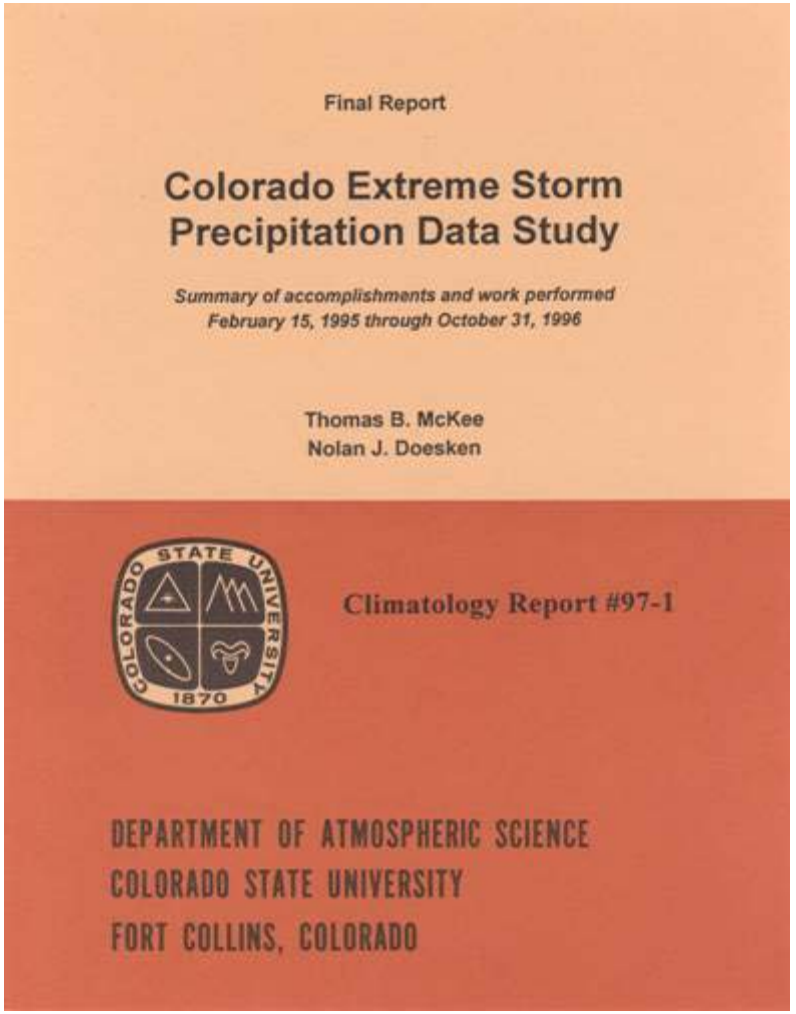


Applications of Climate Monitoring

- Water Management and Irrigation Scheduling

Applications of Climate Monitoring

- Extreme Precipitation Study



Applications of Climate Monitoring

- History of Extreme Rainfall

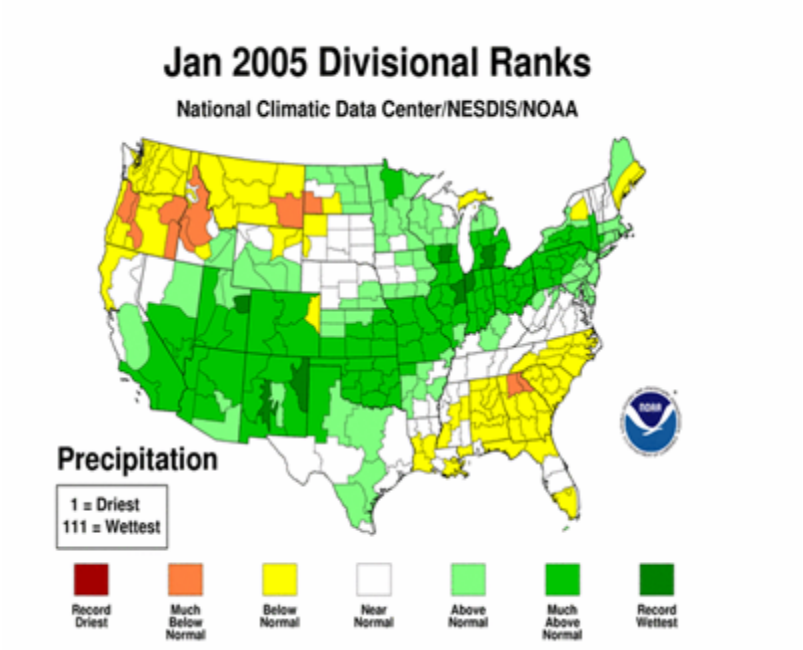
October 1996

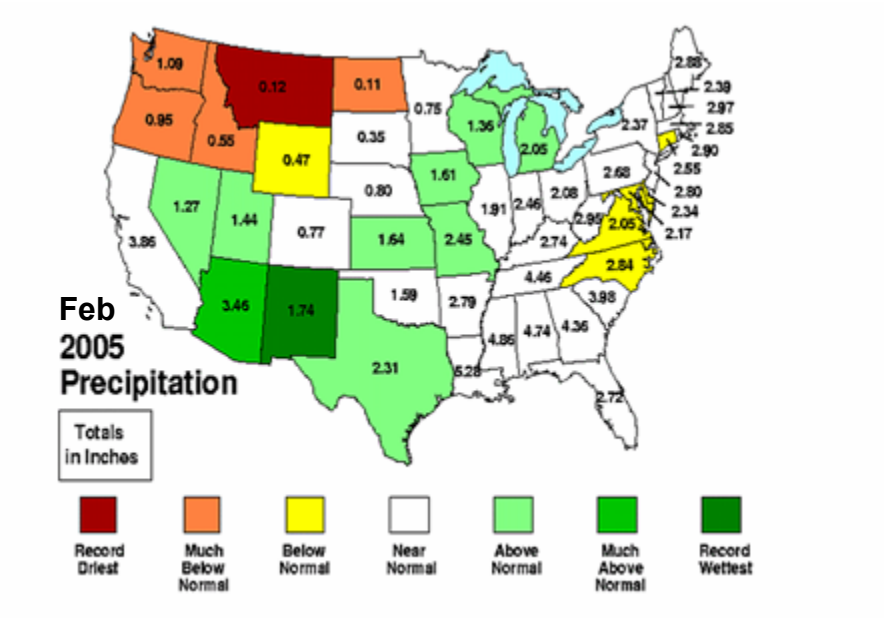
Questionable Storm Precipitation Reports

Storm No.	Storm Name	State	Storm Date	Region	Type	Lat	Long	Maximum Precipitation	Remarks	USBR Storm File	USBR Depth Area Dur. Study
40	Gladstone - San Juan Range	CO	October 4-6, 1911	3	G	37 53	107 39	8.05" 24 hrs, Gladstone, CO Definitely a big storm, but Gladstone precip in question	Large flood Durango and Animas River, many 3-4" totals	X	X
48	Telluride	CO	July 27, 1914	3	LC	37 57	107 49	A storm definitely happened but date of reported heavy rain does not match with date of reported mudslide 3.50" 1 day Telluride	Mudslide 7/27/1914 buried Telluride, precip reported on 8/26/14.		
	Leadville	CO	August 18, 1932	3,4	LC	39 15	106 18	2.96" 1 day, Leadville	Nothing noted on forms, precip occurred in 2 storms		
	Leadville	CO	July 23, 1934	3,4	LC	39 15	106 18	5.33" in 3 days - Leadville	2.01" on 21st		
107	Leadville	CO	July 27, 1937	3	LC	39 15	106 18	4.25", 45 minutes, Leadville	Data very suspicious		
114	Masonville	CO	September 10, 1938	2	LC	40 26	105 13	Local reports in SW Fort Collins of 5-7" <1 hr, reports suspect.	No extreme precip. reports found in CO	X	
158	Cimmaron	CO	June 3, 1952	3,5	GLC	38 24	107 31	5.25" 1 day, Cimmaron	Did it really happen?		
	Cimmaron	CO	September 21, 1952	3,5		38 24	107 31	3.60" 1 day	forms not found		
	Cimmaron	CO	January 20, 1962	3,5		38 24	107 31	6.00" 1 day, Cimmaron	CD notes 10" total precip for month		
226	Eagle	CO	September 23, 1969	6		39 38	106 55	1.54" 24 hrs Eagle	No precip at Eagle (FAA), Incorrect?		
227	Crested Butte	CO	September 25, 1969	3		38 52	106 58	2.30" 24 hrs, Crested Butte	No precip Crested Butte (NWS) or in state on 25th, Incorrect?		
266	Whiskey Creek	CO	August 24, 1982	5	LC	37 13	105 07	3.70" - Whiskey Creek (Snotel site) elevation - 10,220 ft	Measurement suspect, heavy precip in SW CO - some local flooding		
286	Grand Lake	CO	September 28, 1985	4	G	40 16	105 50	3.20" 24 hrs, Grand Lake	Measurement suspect		
295	Scotch Creek	CO	August 19, 1988	3	LC	37 39	108 01	4.10" - Scotch Creek (Snotel site), elevation - 9,100 ft	Measurement suspect		
321	Colorado Springs	CO	September 2, 1994	2	LC	38 49	104 42	5-8" between 9-10:30 pm with lots of hail	Storm occurred but max values of precipitation appear suspect.		
325	Wolf Creek Pass	CO	August 20, 1995	3	LC	37 29	106 47	4.03" in 1 day	Measurement appears suspect		

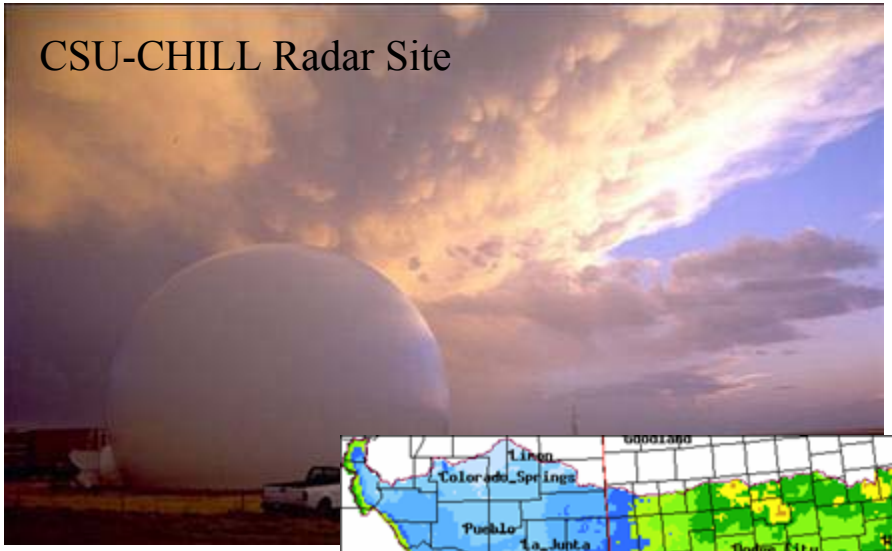
Common Theme from Climate Monitoring Applications is –

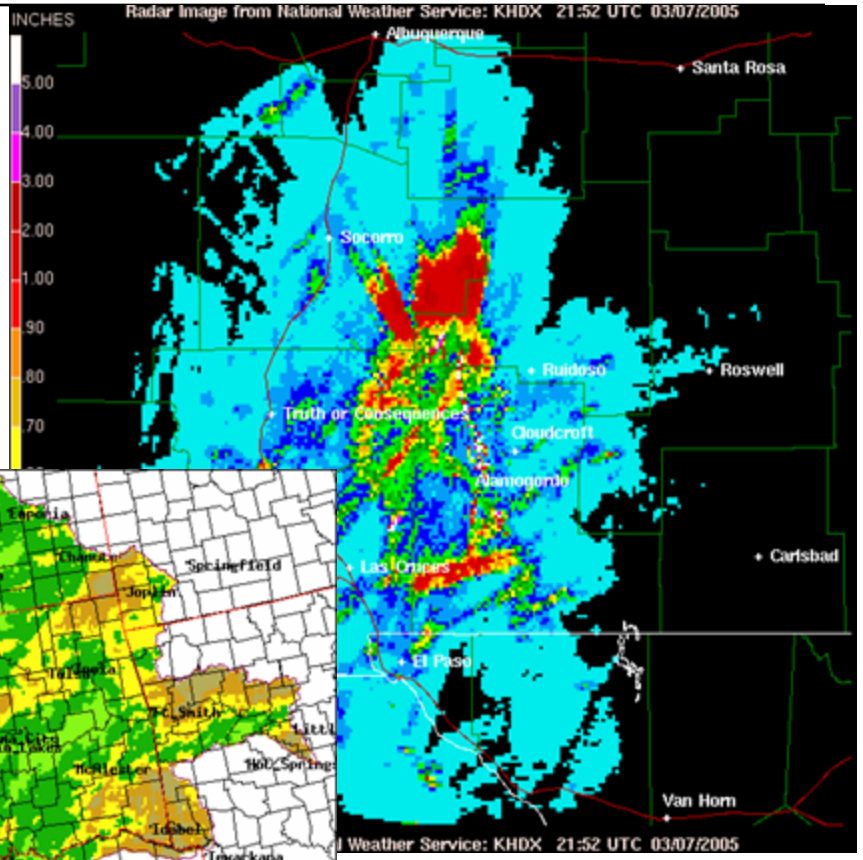
Inadequate Spatial Density of Precipitation Data

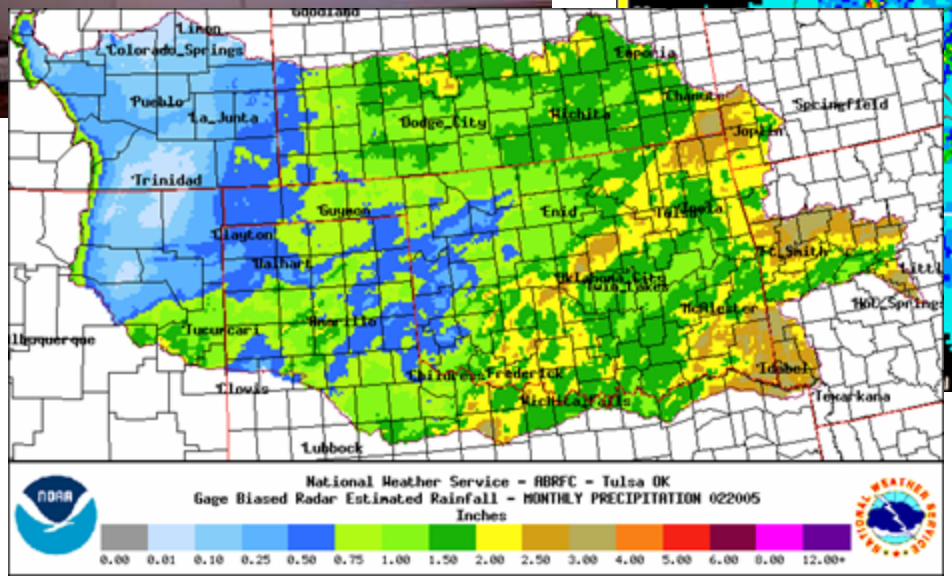




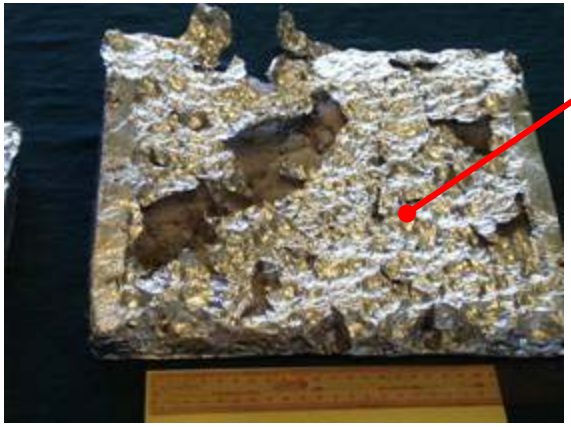
?? How About Remote Sensing ??

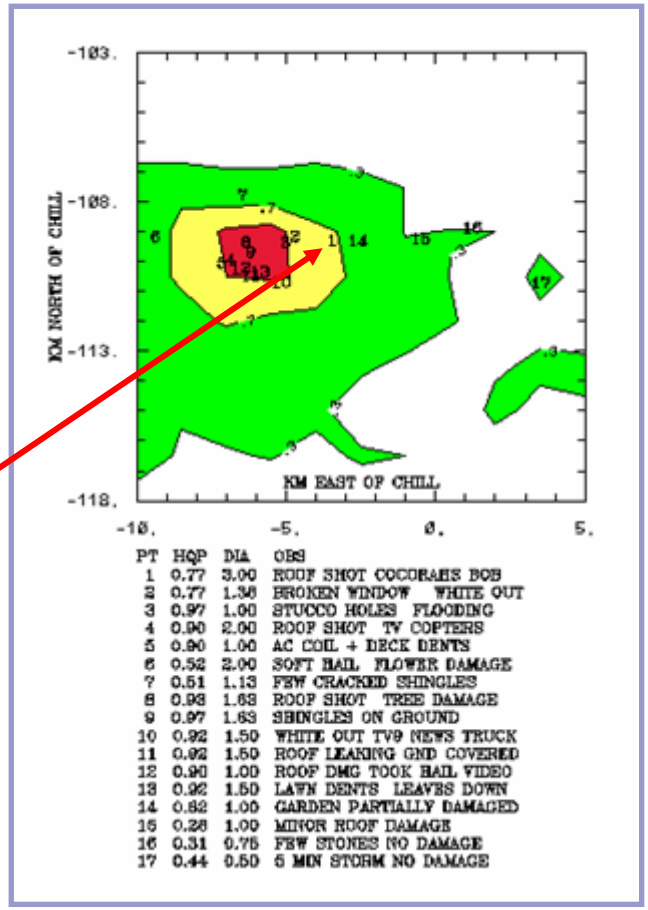






Remote Sensing is Great – But Ground Calibration is Crucial





PT	HQP	DIA	OBS
1	0.77	3.00	ROOF SHOT COCORAHS BOB
2	0.77	1.38	BROKEN WINDOW WHITE OUT
3	0.97	1.00	STUCCO HOLES FLOODING
4	0.90	2.00	ROOF SHOT TV COPTERS
5	0.90	1.00	AC COIL + DECK DENTS
6	0.52	2.00	SOFT HAIL FLOWER DAMAGE
7	0.51	1.13	FEW CRACKED SHINGLES
8	0.93	1.63	ROOF SHOT TREE DAMAGE
9	0.97	1.63	SHINGLES ON GROUND
10	0.92	1.50	WHITE OUT TV9 NEWS TRUCK
11	0.92	1.50	ROOF LEAKING GND COVERED
12	0.90	1.00	ROOF DMG TOOK HAIL VIDEO
13	0.92	1.50	LAWN DENTS LEAVES DOWN
14	0.82	1.00	GARDEN PARTIALLY DAMAGED
15	0.28	1.00	MINOR ROOF DAMAGE
16	0.31	0.75	FEW STONES NO DAMAGE
17	0.44	0.50	5 MIN STORM NO DAMAGE

Red Arrow indicates location of CoCo RaHS observer. Resulting hailpad and retrieved hailstones. CoCo RaHS observations are also providing valuable spotter information to the National Weather Service.

Contour map of hail quadrature parameter (HQP) showing potential hail damage from a severe thunderstorm in Douglas County, CO, in July 2002. The data were produced from the CSU-CHILL Polametric Radar. CoCo RaHS data are being used as ground validation for the CSU-CHILL hail and rainfall products.

How can we gather more data without breaking the bank??

Community Collaborative Rain, Hail and Snow Network

The Origin of CoCoRaHS

The Fort Collins Flood of July 28, 1997

What is CoCoRaHS?

CoCoRaHS is a unique, non-profit community based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow).

"By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, our aim is to provide the highest quality data for natural resource, education and research applications."

CoCoRaHS: Simple tools to study rain

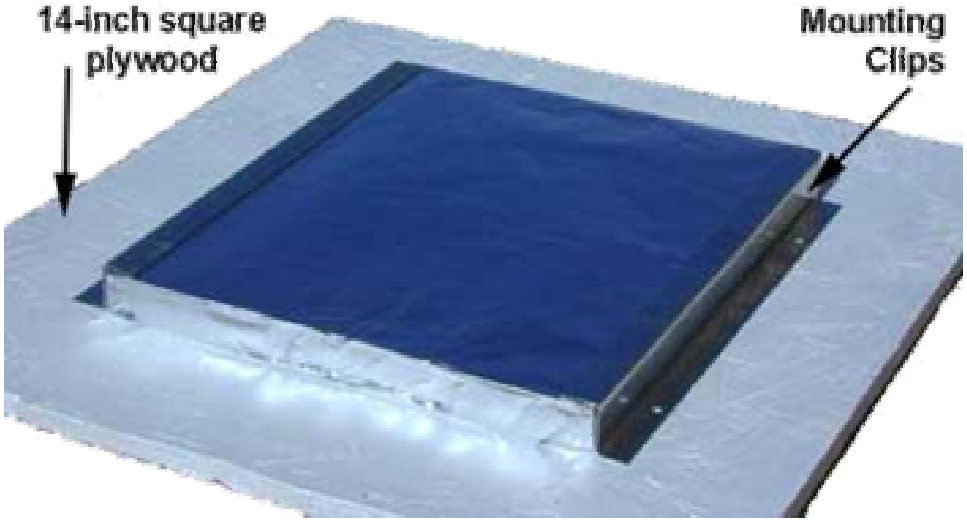
Rain Gauge

Example Station

CoCo RaHS Gauge in March 2003 Snowstorm

Arapahoe County CoCo RaHS observer near Cherry Creek, Colorado

CoCoRaHS: Simple Tools to Study Hail



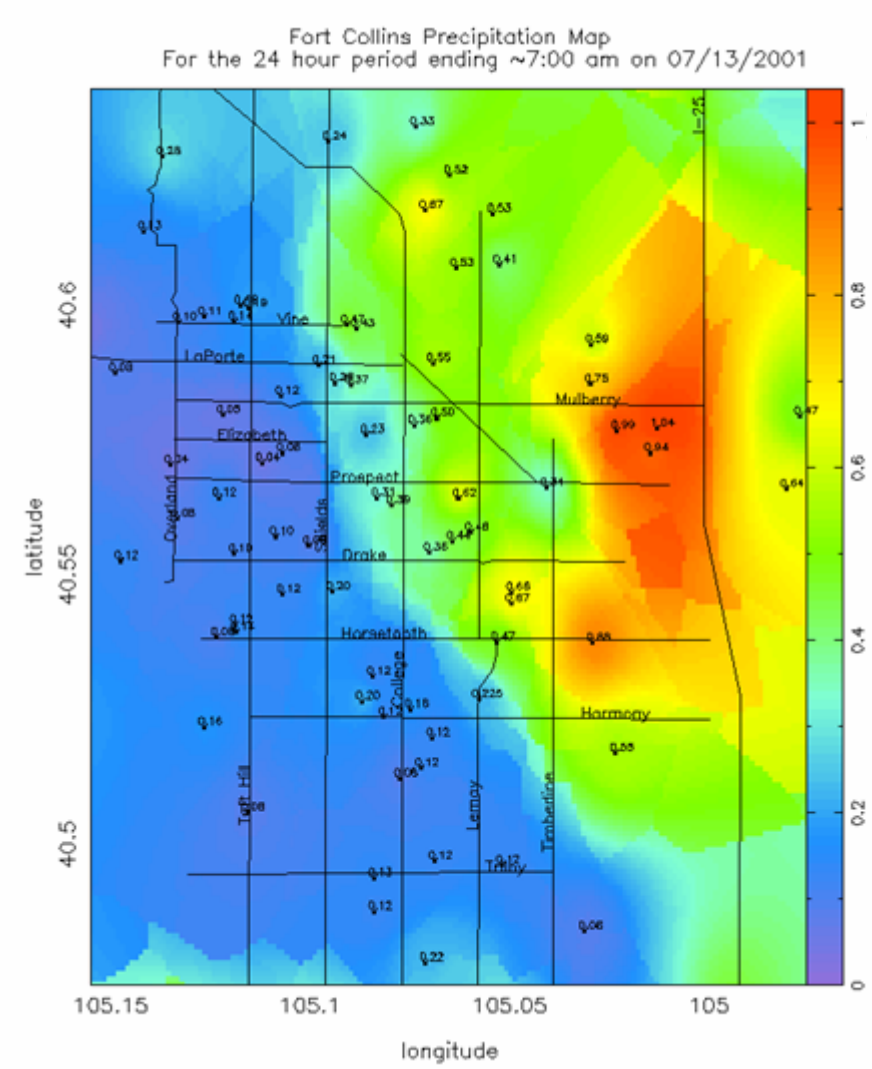
Hail Pad

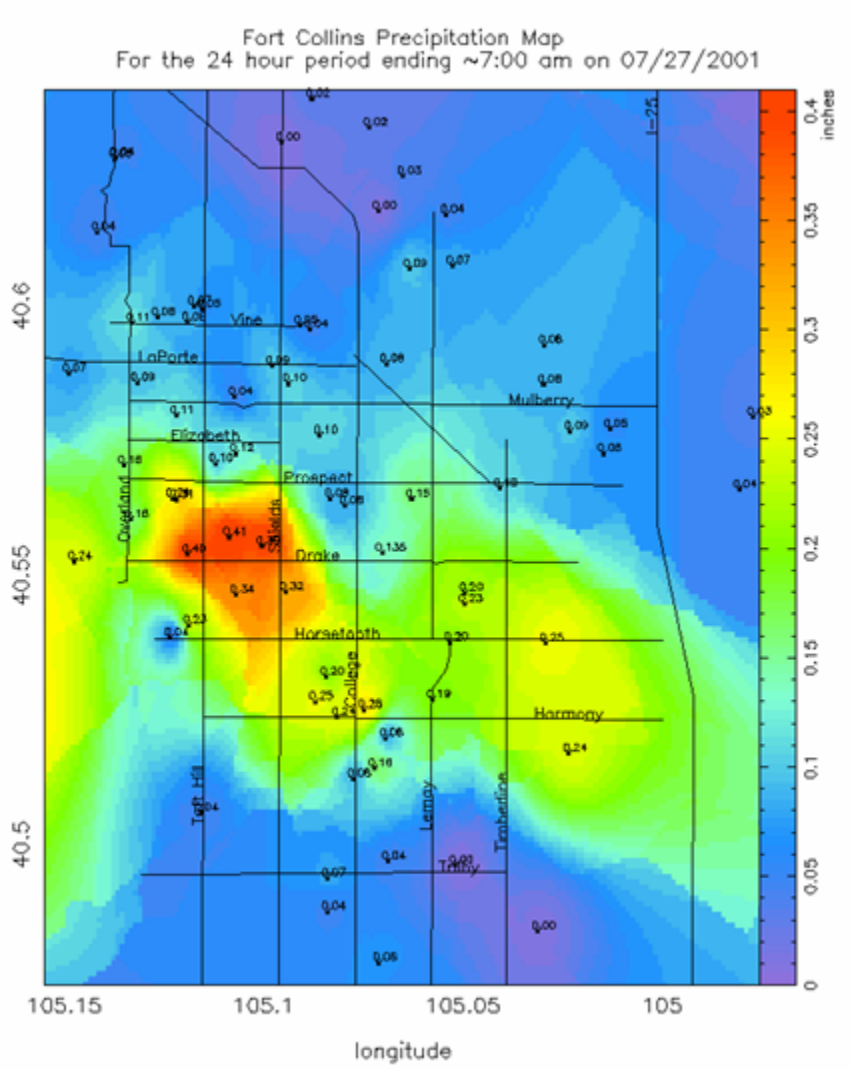
Damaged Hail Pad

Example Hail Pad Stands

CoCoRaHS -- Supplementing NWS Cooperative Program to Improve Precipitation Measurements.

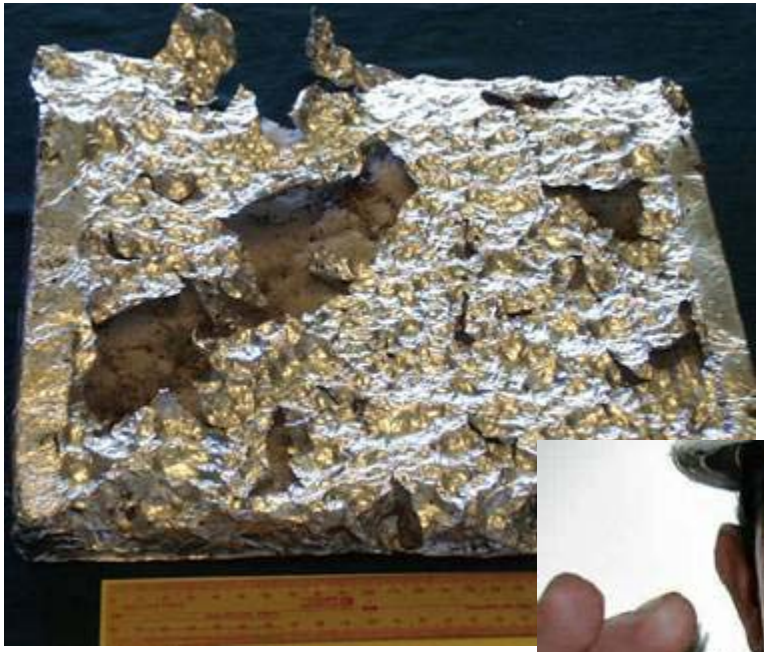
Fort Collins Daily Rainfall Examples



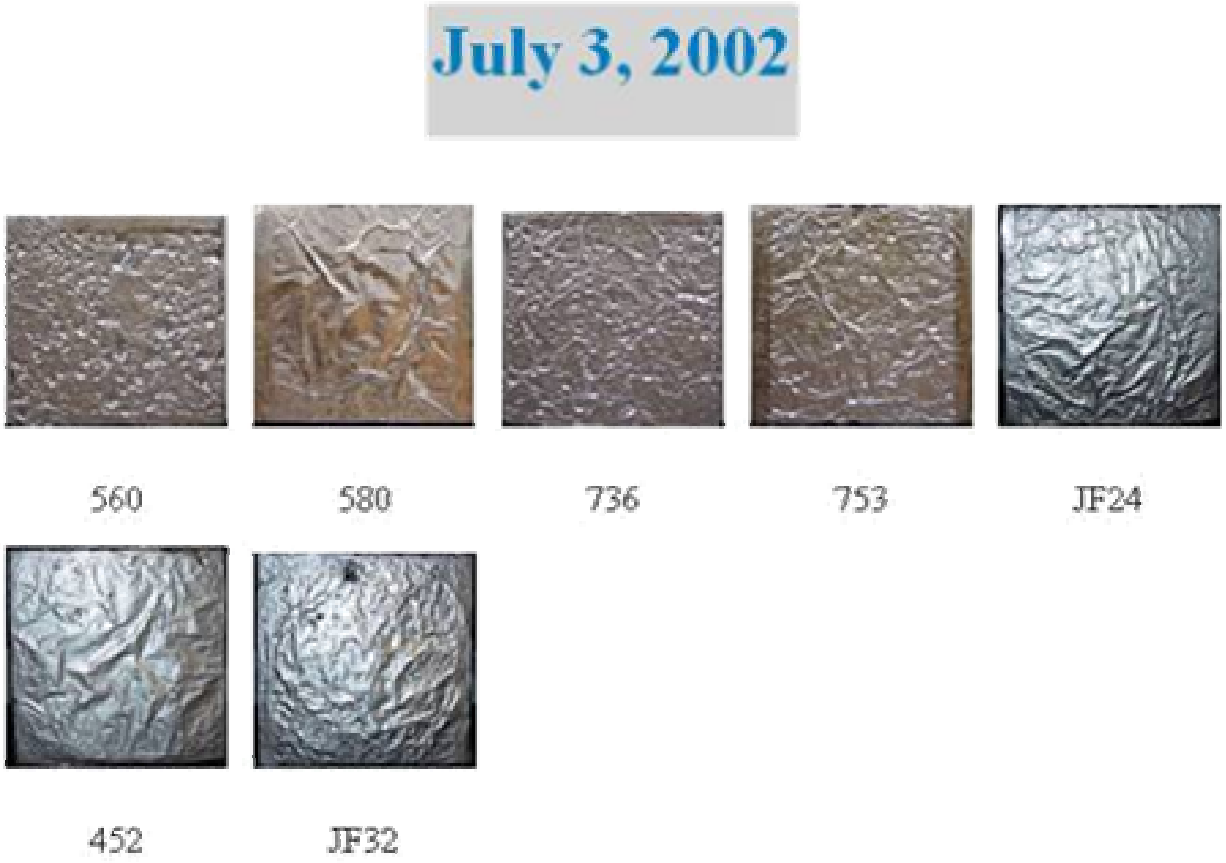


Colorado Hailstorm

July 10, 2002, Parker, CO



Example Page from CoCoRaHS Web Site of Damaged Hail Pads



Expanded Hail Information from Web Site

Date: 7/3/2002
Hail Began: 2:56pm
Hail Lasted: 10 minutes

Station Number: 560
Name:Greeley 4.3 NNW
County: Weld

Common Stones: Pea
Largest Stones: Marble
Smallest Stones: Pea

Hailfall was: Intermittently

Hailstones were: Hard, Mixed

Hail started: same time as rain

Average distance between stones: 1/16 inches

Depth of hail:

Comments:None

The Quality of Our Data Comes Through the Extensive Training of Our Volunteers

Sample Training Materials

Setting up your equipment

Location! Location! Location!

Photo by Henry Reges

It's the key to good data

Measuring Rain

To measure this amount . . .

Pour out the first inch from the inner tube

Now pour the remaining water into the funnel & measure using the inner tube.

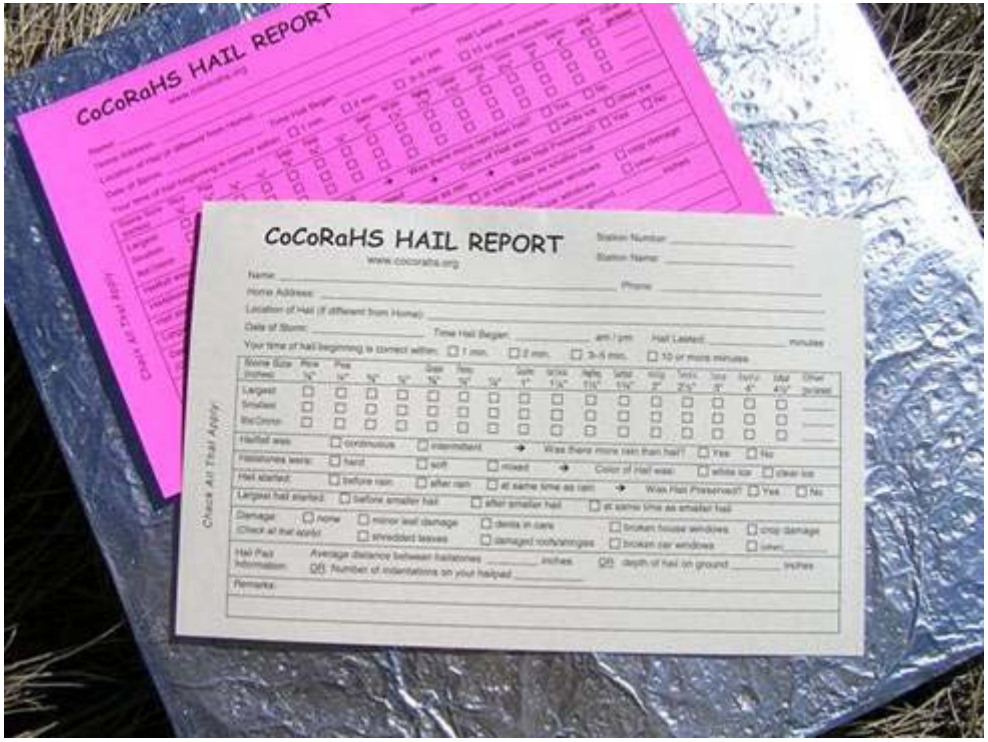
Measuring Snow

Snow measured in the open

6.5 inches has fallen in the open

Reporting Hail

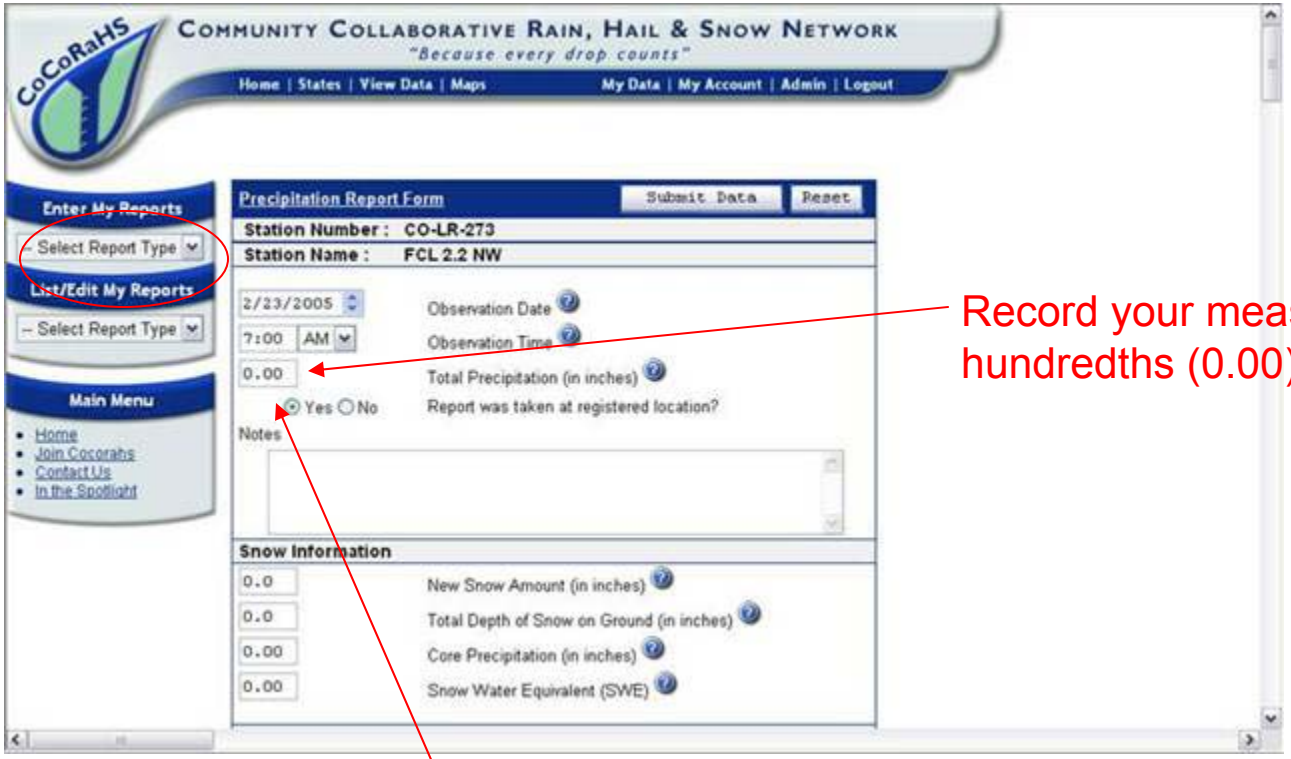
As hail is falling . . .



fill out your CoCoRaHS Hail Report Card. After the storm is over attach it the back of the pad.

Using the Web Site

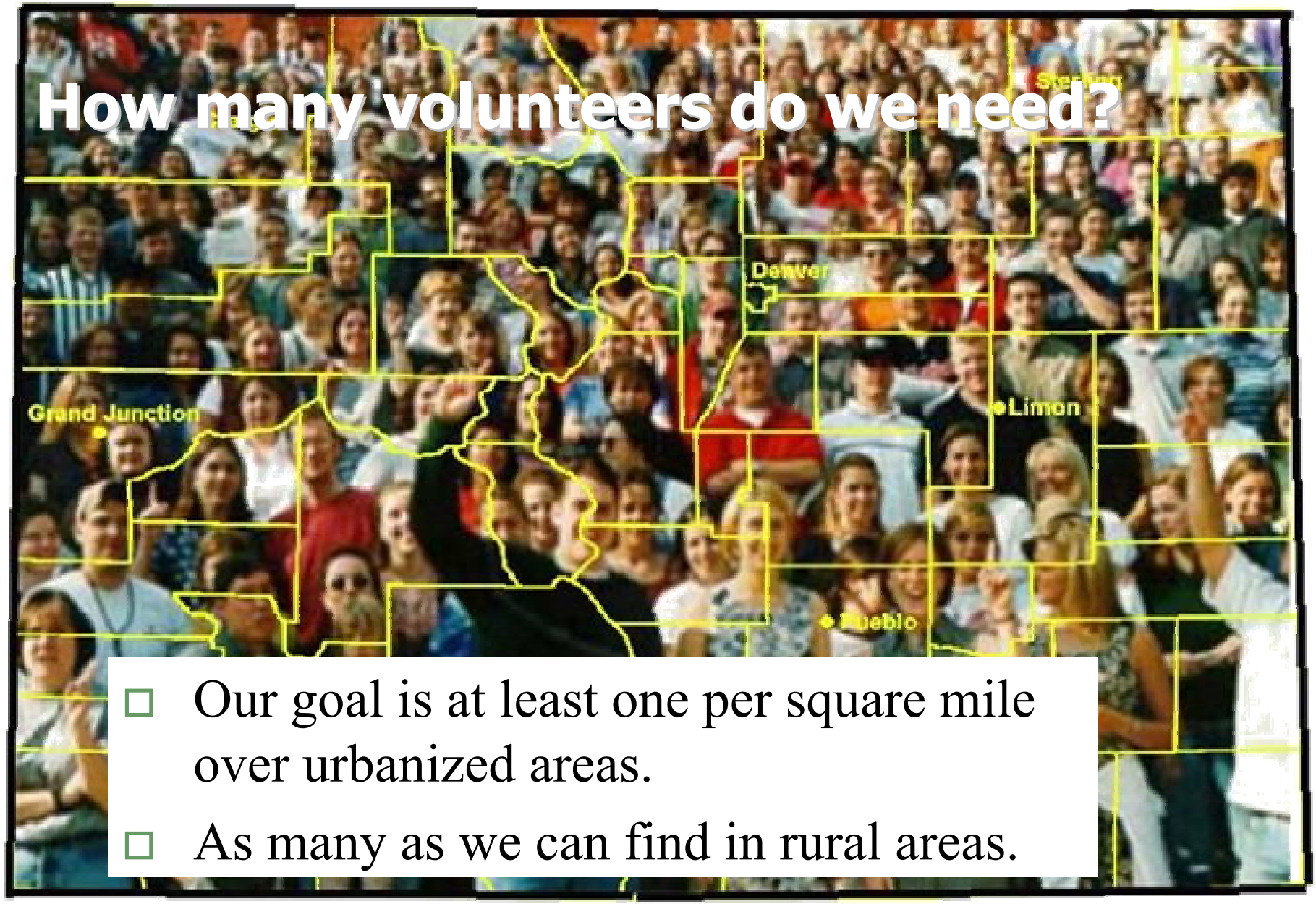
Enter your report



Record your measurement in hundredths (0.00)

Here you will enter the total precipitation measured in your gauge

How many volunteers do we need?



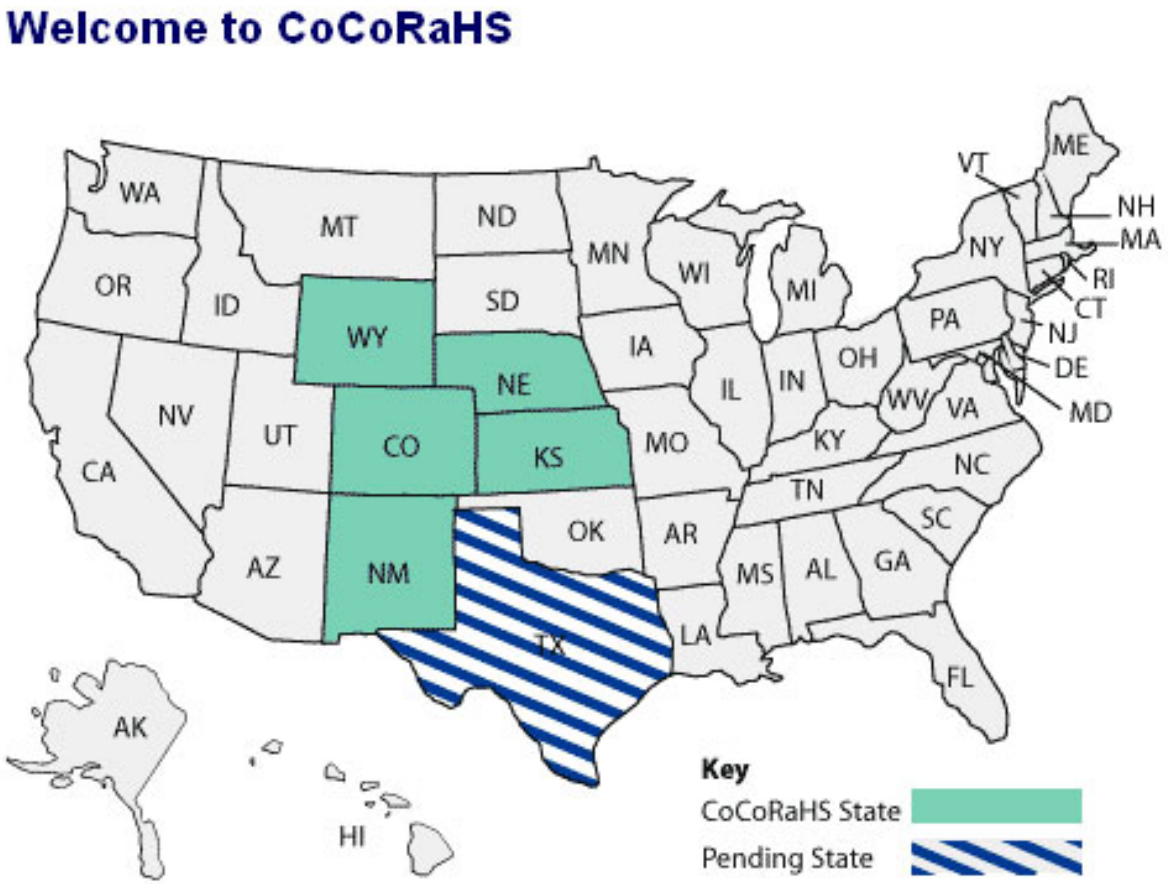
- Our goal is at least one per square mile over urbanized areas.
- As many as we can find in rural areas.

CoCo RaHS is Growing!!

- More states,
- More staff,
- More collaboration,
- More science,
- More education,

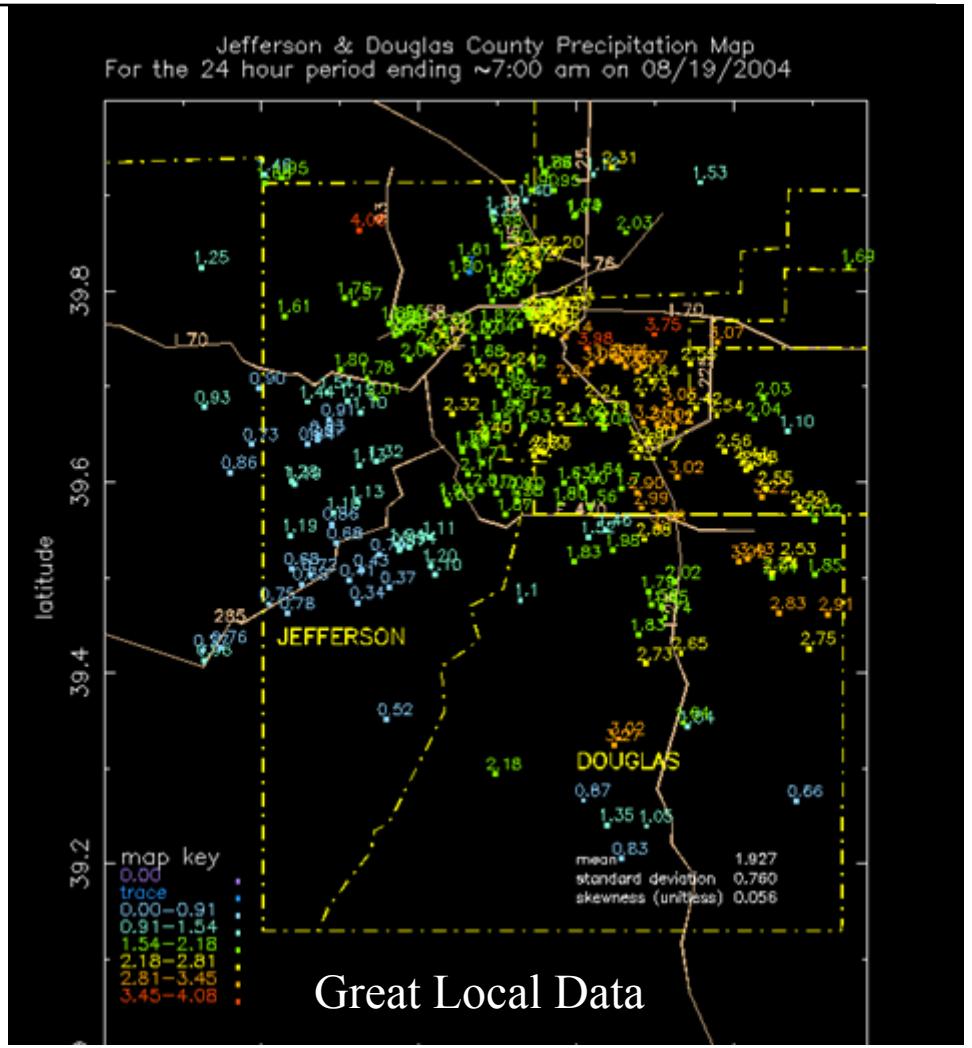
  and
- Many more participants.

Participating CoCoRaHS States



The Benefits of CoCoRaHS

Learning Together



Great Local Data

For More Information, Visit the CoCoRaHS Web Site

http://www.cocorahs.org

Support for this project provided by
Informal Science Education Program,
National Science Foundation
and
many local charter sponsors.

Colorado Climate Center

Data and Power Point Presentations available for downloading

http://ccc.atmos.colostate.edu

- click on “Drought”
- then click on “Presentations”

Colorado State University
Knowledge to Go Places